

What is a tree, anyway?

Tree: a tall (>2 m) perennial woody plant with a main trunk and branches forming a distinct elevated crown

Forest: continuous or nearly continuous cover by trees = less than half of the Earth's land surface

So, many environments are too harsh (dry, cold) for trees!
What are the special constraints of being a tree?

SPECIAL BIOLOGY OF TREES

Trees carry out the same life functions as smaller plants. Their large size and long life spans make these functions more challenging than for smaller plants.

What are the special challenges of large size?

1. growth
2. transport of water, nutrients, food
3. coordination of parts

of long life span?

1. defense against animals, disease
2. repair, regrowth after damage (phys, biol)
3. environmental variations
 - phenotypic plasticity
 - "genetic buffering"

Large Size: 1. Growth

Remember last lecture

totipotency

meristems

modules

Large Size: 2. Transport of water, nutrients, food

Water (in xylem)

- from roots, through stem, out of leaves
- evaporation through stomates "pulls" water through stem
- xylem potential is a measure of the tension of water in xylem

Stomates:

open closed

CHALLENGE = CAVITATION (break in hydraulic pathway due to tension or freezing) PREVENTS WATER MOVEMENT (conductivity)

Do xylem characteristics affect cavitation rates?

This question is still debated!

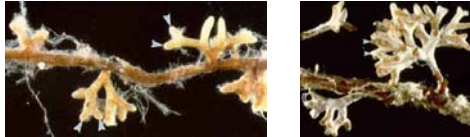
ring porous (Ang.)
diffuse porous (Ang.)
conifer wood

topic of 2 adaptation papers

Large Size: 2. Transport of water, nutrient, food

Nutrients (in organic compounds in xylem)

- move passively in solution with water
- uptake enhanced by mycorrhizae

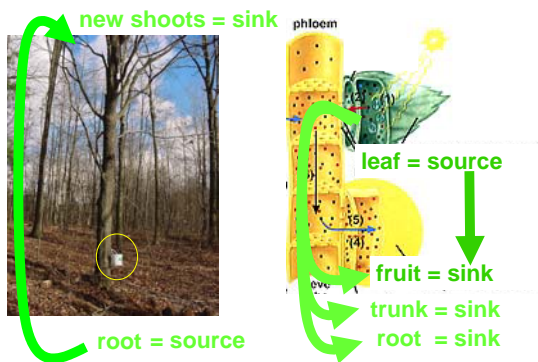


Large Size: 2. Transport of water, nutrient, food

Food (sugar) (in phloem)

- produced in leaves
- used in leaves, flowers, fruits, stems, roots
- stored in stems, roots

Large size: 2. Transport of food (source-sink relationships)



Large Size: 3. Coordination of parts

Trees are made up of many interdependent parts.

How do the parts “communicate?”

- hormonal signals (e.g. auxin, abscisic acid)

black cottonwood
(*Populus trichocarpa*)



COORDINATION: Hormones (e.g. auxin)

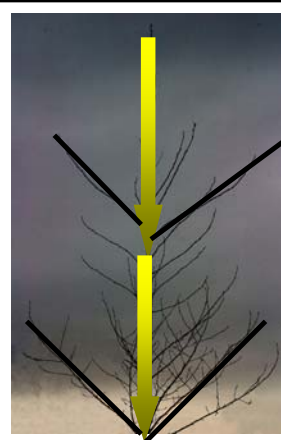
Hierarchy of long shoot growth

- What variations do you see?
Some branches are long
Some branches are short
- What patterns do you see?
Long branches are “grouped”

Hierarchy of long shoot growth (continued)

What: Apical dominance


The gradient in auxin (produced in terminal bud) inhibits growth of lateral buds in same year. So, there is a gradient in lateral branch lengths for a given year.



So what:

Major branches are well-spaced in groups.

Hierarchy of long shoot growth



■ = 2004 growth
 = 2005 growth

- from terminal buds
- from lateral buds

You should be able to analyze annual growth of trees you see.


COORDINATION: Long Shoots vs Short shoots



black cottonwood (*Populus trichocarpa*)

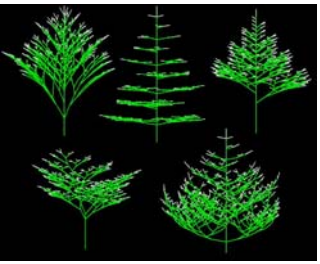
black cottonwood (*Populus trichocarpa*)

Larch (*Larix*)



black cottonwood (*Populus trichocarpa*)

Diverse tree forms can result from the same basic "rules" of growth



COORDINATION: Hormones (e.g. abscisic acid)

"Stress Hormone"

Synthesized in root tips (and probably leaves)

Synthesis stimulated by "stress" conditions (e.g., low water availability, short days?)

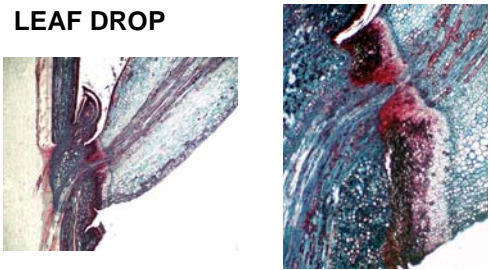
Mode of "communication" between roots and shoots

Role in:


- leaf drop (abscission)
- bud dormancy
- stomatal closure
- seed dormancy

COORDINATION: abscisic acid

LEAF DROP

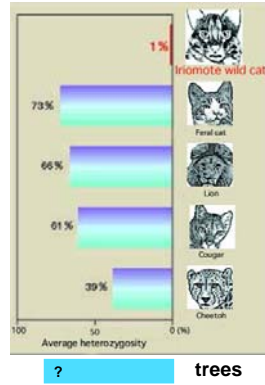


BUD DORMANCY



Genetic "buffering," high levels of heterozygosity (% of gene loci with >1 allele)

Do multiple alleles allow function across a broad range of environments?



Long Life: orderly senescence

- Why do plant parts have to senesce and die?
- Priorities?

